

Claims

We claim:

1. A multistage submersible axial-flow pump with axial stages arranged sequentially on the shaft inside casing, each of these stages contains guide vanes and a hub-shaped impeller, and the diameter of the impeller hub d_{hub} at the impeller inlet equals to

$$d_{hub} = D_{extimp} \times \sqrt{1 - \left[\frac{K_D}{D_{extimp}} \times \left(\frac{Q}{60n} \right)^{1/3} \right]^2},$$

where D_{extimp} – external diameter of impeller, m;

$K_D = 3.2 \div 4.5$ – factor of impeller diameter;

Q – capacity of pump, m³/s;

n – rotational speed.

2. The pump of claim 1, wherein the end washers are fixed at the face surfaces of the hub and are made of antifriction wearproof material, the blades are arranged at the lateral surface of the hub along the helical line with the lead of helix of

$$S = \frac{\pi \times D_{extimp} \times (1 + \bar{d}_{hub})}{2} \times \operatorname{tg} \left[2 \times \operatorname{acrtg} \left(\frac{480 \times Q}{\pi^2 \times D_{extimp}^3 \times n \times [1 + \bar{d}_{hub}] \times [1 - \bar{d}_{hub}^2]} \right) \right],$$

where $\bar{d}_{hub} = \frac{d_{hub}}{D_{extimp}}$ – hub ratio at the impeller inlet.

3. The pump of claim 1, wherein the inlet edges of the blades are rounded and the inclination angle of the blades relative to the face surfaces of the hub obey the law

$$\beta_{bl}(r_i) = \arctg\left(\frac{S}{2 \times \pi \times r_i}\right),$$

where $\beta_{bl}(r_i)$ – inclination angle of blades at the radius r_i ;

S – lead of helix;

r_i – radius measured from the impeller axis till the current point at the blade surface.

4. The pump of claim 1, where the density of the blade lattice at the external diameter has the value of

$$\tau_{extimp} = \frac{l_{extimp} \times Z_{imp}}{\pi \times D_{extimp}} = 0.7 \div 1.3$$

Where τ_{extimp} – density of the blade lattice

l_{extimp} – blade length at the external diameter

Z_{imp} – number of blades

5. The pump of claim 1, where each stator guide vanes contain a hub with two end shoulders at their face surfaces, the radial vanes are installed at lateral surface of the hub along the direction parallel to the stage axis, and both inlet and outlet edges of vanes are rounded. Density of circular vane lattice at the middle diameter has the value of

$$\tau_{avgv} = \frac{l_{gv} \times Z_{gv}}{\pi \times D_{avgv}} = 0.8 \div 1.6,$$

where τ_{avgv} – density of the circular vane lattice;

l_{gv} – vane length

Z_{gv} – number of vanes